



*Long Duration Energy Storage Council  
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## **House of Lords Science and Technology Committee: Call for Evidence, Long Duration Energy Storage**

### **Response from Long Duration Energy Storage Council.**

The Long Duration Energy Storage Council (LDES Council) welcomes the opportunity to respond to the Committee's Call for Evidence. The LDES Council is a global non-profit with over 70 members across 20 countries. The LDES Council works to accelerate the decarbonisation of our world through the application of long duration energy storage (LDES). The LDES Council provides member-driven, fact-based guidance and research to governments, grid operators and major electricity users on the deployment of long duration energy storage for society's benefit by decreasing emissions, lowering costs and adding flexibility to energy systems allowing for more resiliency. The LDES Council would welcome the opportunity to provide further oral or written evidence as needed by the Committee.

#### **1. How much medium- and long-duration energy storage will be needed to reach the Government's goal of a fully decarbonised power grid by 2035 and net zero by 2050, and by when will it need to be ready?**

Analysis by the LDES Council finds the UK will need 30 GW of long duration storage by 2035 and 50 GW by 2050. This is consistent with our global analysis, which indicates investment of up to USD 4 trillion to provide installed capacity of up to 8 TW (power and heat) could save global systems up to USD 540 billion if developed early.

There are many benefits and needs for grid connected long duration energy storage including congestion management, load following (quickly adjusting generation and storage to meet demand), inertia, blackstart capabilities and more. Efficient deployment of long duration energy storage also reduces the total required build out of new renewable resources and new transmission and distribution infrastructure.

All realistic scenarios for decarbonising the UK's power grid, and then ultimately achieving net zero carbon emissions, draw heavily on variable sources of renewable electricity, particularly offshore wind. Storage allows for the opportunity to charge when renewable (wind and solar) generation exceeds demand and deliver energy back to the grid when output from renewables is less than total demand within a single operating day. Long duration energy storage connected to the grid amplifies this ability and allows large quantities of energy to be stored during prolonged periods where generation exceeds demand. These resources also provide added system resilience, as storage resources with long durations, by nature, are able to provide energy for longer periods of time and thus reduce the likelihood of unserved demand.



Many LDES technologies are deployed today (for example there is nearly 3 GW of Pumped Storage Hydropower in the UK), with new contracts being entered into globally, and complemented by ongoing innovation across the family of technologies. It is essential that we increase the scale of deployment now, through appropriate targets and market structures that incentivise investment, in order to fully unlock the benefits these technologies bring.

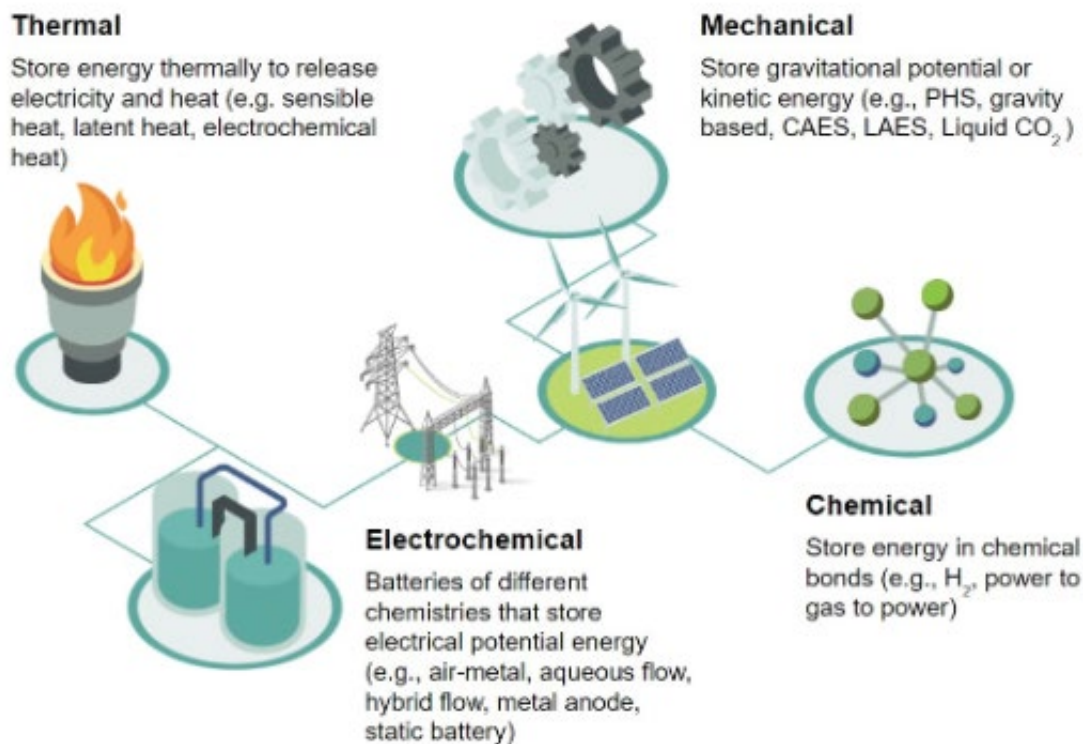
## **2. How sensitive is the amount of storage needed to assumptions about the future balance of supply and demand on the grid?**

It is clear that a wide range of technologies will be essential (to some extent) to deliver a net zero grid. However, long duration storage directly complements offshore wind, the bedrock of the UK's power system decarbonisation strategy. Other technologies may play a supporting role but long duration storage is supremely well positioned to enable the most efficient deployment of offshore wind by providing back-up generation at times of low supply through the storage of surplus energy at times of excess supply

## **3. Which technologies can scale up to play a major role in storage?**

There is a need for diversity in LDES technologies as they play a wide range of different roles, supporting the most efficient pathways to decarbonisation across many sectors including heat. Long duration energy storage can be achieved through different approaches, including mechanical, thermal, electrochemical, or chemical storage. See Figure 1 below.

**Figure 1: the 4 Families of Long Duration Energy Storage**



With reference to the Committee's questions on heat.

There are a wide range of technologies that can store heat, and they should be seen as an essential component of the transition to net zero. Heating accounts for around 37% of UK emissions and LDES offers a clean flexible solution to secure heat. Thermal Energy Storage (TES) can decarbonise heat applications by electrifying and firming heat with variable renewable energy sources. In addition, it can optimise heat consumption in industrial processes and facilitate the reuse of waste heat or the integration of clean heat sources (for example, from thermal solar).

TES covers a variety of technologies that can address a wide range of storage durations (from intraday to seasonal) and temperatures (from subzero to 2,400°C). According to 2022 LDES Council analysis TES enables cost-efficient electrification and decarbonization of the most widely used heat applications, namely steam and hot air. The benchmark results also indicate that firming heat is very cost-efficient when the final demand is heat. Some TES technologies are already commercially available with various easy-to-customize uses. To date, the most commonly deployed TES technologies include medium-pressure steam, with various applications, including in the chemicals or food and beverage industries. Additionally, developing technologies will expand the Thermal Energy Storage solution space with innovative concepts and address temperature needs well above 1,000°C.

**4. What policy support is currently in place to support deployment of storage technologies? Is it sufficient to support deployment at scale?**



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The UK government provided innovation funding, for example awarding over £32m through the Longer Duration Energy Storage competition.

Such support is important in enabling the sector to develop, but insufficient on its own. Like most low carbon infrastructure, many long duration energy storage technologies have higher upfront capital costs (CAPEX) and lower ongoing operating costs (OPEX) compared to fossil fuel alternatives. Therefore, attracting private investment and financing needed for grid scale deployment requires market arrangements that provide long term revenue visibility.

A primary means to ensure buildout of long duration storage includes requiring load serving entities to procure specific quantities of storage resources of specific duration (such as a specified number of megawatts of 8 hour duration storage, a specified megawatt amount of 20 hour duration and so on). This ensures procurement and results in long-term contracting, ensuring that the full cost of storage resources are recovered for investors in these long term contracts.

There are specific mechanisms to make terms of these contracts less burdensome to implement and potentially less expensive. These include Contracts for Differences (as used in offshore wind, providing a specific price per MW of electricity over a 15 year term ) and Cap and Floor agreements which ensure a base amount of annual net revenue (the floor) from the energy markets and limit net revenues (the cap). The LDES Council would be happy to provide the Committee with further detail on how these mechanisms can be developed and implemented to help ensure efficient deployment of these essential technologies.

Furthermore, wider interventions such as carbon pricing that reflects the true social cost of fossil fuel emissions can help to ensure a more level playing field between solutions.

**5. How well developed is the UK industry across different storage technologies, such as hydrogen or redox flow batteries? How does the UK compare to global competitors in these industries?**

The LDES Council has many members who are based in and / or active in the UK (see <https://www.ldescouncil.com/members/>). This diversity of members reflects the wide ecosystem of LDES technologies and the breadth of services that they can provide - covering multiple time scales, ancillary services and end users. Strong UK Government support for LDES will help the UK unlock these opportunities domestically and abroad.

**6. Beyond the cost of deploying long-duration energy storage, what major barriers exist to its successful scale up (e.g. the availability of a skilled workforce, the ability to construct the necessary infrastructure on time, or safety concerns around new technologies)?**

The deployment of any new industry sector at scale and pace requires a developed supply chain and the necessary skilled people to deliver.



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Investors will only invest in this capacity building if they are clear that there is realistic long term business potential. Providing this confidence requires a coherent linked strategy on the part of government, a commitment to reforming market structures to incentivise flexibility, setting ambitious but achievable specific targets for long duration storage procurement with a roadmap to delivery, deep engagement with industry to understand the technology and overall possibilities, and commitment to decarbonisation.

## **7. What steps should the Government take now to ensure this storage can come online later in the current decade?**

Setting specific targets for buildout on the grid in future years is critical to ensure that the market has clear signals and that capacity is built on time. These targets should be backed up with the appropriate market mechanisms that incentivise the flexibility and storage that LDES technologies bring to the grid and other sectors.

Furthermore, it is important to note that the most efficient solutions over time may not be those that can be deployed quickest. Therefore it is important that the Government engage in sophisticated long term planning for the future of the grid now, including consideration of the full range of deployed and emerging LDES technologies, to ensure that the UK can decarbonise in the most efficient way possible.

**LDES Council**  
**11 September 2023**